

PATENT COOPERATION TREATY

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 03 FEB 2006

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Applicant's or agent's file reference P11695WO/DAK	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB2003/004739	International filing date (day/month/year) 04.11.2003	Priority date (day/month/year) 04.11.2003
International Patent Classification (IPC) or both national classification and IPC F02M5/02		
Applicant DELPHI TECHNOLOGIES, INC.		



- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 2 sheets.

- This report contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 03.06.2005	Date of completion of this report 06.02.2006
Name and mailing address of the International preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Hakhverdi, M Telephone No. +31 70 340-2240 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/GB2003/004739

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-10 as originally filed

Claims, Numbers

1-6 received on 25.07.2005 with letter of 20.07.2005

Drawings, Sheets

1/2, 2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-6
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-6
Industrial applicability (IA)	Yes: Claims	1-6
	No: Claims	

2. Citations and explanations

see separate sheet

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Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

Reference is made to the following documents:

- D1: EP 0704619 A1
- D2: DE 19544241 A1.
- D3: WO 03/081025 A1

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1-6 does not involve an inventive step in the sense of Article 33(3) PCT.

1. The document D1 is regarded as being the closest prior art to the subject-matter of claim 1, and discloses (cf. column 2, line 12 to column 3, line 2; figures 1-3) an accumulator fuel system for an internal combustion engine having a plurality of engine cylinders, the fuel system including a plurality of injectors (4), each of which is arranged to supply fuel to an associated one of the engine cylinders, a rocker shaft (8) upon which a rocker member is pivotally mounted, wherein the rocker member is arranged to control one or more inlet and/or exhaust valves (13,14) of an associated engine cylinder, an accumulator fuel volume (3) integrated within the rocker shaft (8) for supplying high pressure fuel to one or more of the plurality of injectors (4), wherein the accumulator fuel volume (3) is arranged to supply fuel at a first pressure level to one or more of the plurality of injectors (4).
 - 1.1 The subject-matter of claim 1 differs therefore from this known accumulator fuel system in that each injector includes a pumping element for pressurising fuel to a second pressure level higher than the first pressure level.
 - 1.2 Starting from state of the art represented by D1, it is not clear from the description of present application which problem is solved by the above mentioned distinguishing features. The problem addressed in the original application is to solve the disadvantage of common rail housing occupying a large space and being relatively heavy and costly feature of the engine. This problem and its solution is not new (see document D1). Furthermore, according to the original application the type of the injector (unit pump-injector or injector comprising piezoelectric or electromagnetic nozzle control valve) does

not have direct influence on the arrangement of the accumulator volume within the rocker shaft. Therefore, the distinguishing features of claim 1 on file cannot contribute to solution of a common problem, because providing each injector with a pumping element for pressurising fuel to a second level has no direct influence on the arrangement of the common rail in the rocker shaft. It is to be noted that features which do not mutually influence each other to achieve a technical effect over and above the sum of their individual effects are to be considered individually for assessment of inventive step; the question is whether each group, considered on its own, is derivable from the prior art in an obvious manner.

- 1.3 As mentioned above, D1 suggests an accumulator fuel system having an accumulator fuel volume (3) integrated within the rocker shaft (8) for supplying high pressure fuel to one or more of the plurality of injectors (4). The remaining features of claim 1 relate to injectors including a pumping element, which are conventional components of fuel injection system of modern engines. Replacing the electromagnetically actuated injector shown in D1 with another type of known injector with integrally formed pumping elements for pressurising fuel to a higher pressure level would have been an obvious option for the skilled person, who would have been aware that a unit pump-injector can, in combination with an accumulator arranged in an engine component, generate higher pressure level as suggested for example by document D2 (cf. column 3, line 65 to column 4, line 17; figures 1,3). Furthermore, the replacement of the electromagnetic injector of D1 by a known unit pump-injector would not necessitate any substantial modification of the engine or its rocker shaft involving an inventive activity of skilled person to arrive to an accumulator fuel system having the features of claim 1.
- 1.4 The argumentation of the applicant in his letter of reply dated 7 October 2005 concerning the difference between the pressure level in the accumulator according to claim 1 and in the accumulator according to D2 cannot be followed, because the claim 1 specifies only that the second pressure level is higher than the first pressure level, which is also the case in D2. Contrary to the opinion of the applicant, it is not clear from the claim 1 that the injectors are operable to inject fuel at the first pressure level during period of low engine power demand and at the second higher pressure level during period of high engine power demand.
- 1.5 Furthermore, the applicant argues that common rail technology and unit pump technol-

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ogy are functionally distinct injection schemes and there would not be technical prejudice against combining these two technologies. Regardless of the fact that the application discloses (page 9, last paragraph) the case where the rail volume supplies fuel to the injectors but there is no additional pumping element in the injector to increase fuel pressure above rail pressure, it should be noted that the combination of common rail technology and unit-pump technology has already been suggested in the prior art, see for example D3, page 6, line 19 to page 10, line 8, figure 1. According to this document the injectors are operable to inject fuel at the first pressure level from an accumulator when operating the engine at low loads and idle and at the second higher pressure level from a pump-injector unit during period of high engine power demand.

- 1.6 It follows from the above that the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT.
- 1.7 Dependent claims 2-6 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step, because the features of claim 2 are known from D1 and the features of claims 3-6 are known from D2.

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EPO - DG 1

CLAIMS

25. 07. 2005

1. An accumulator fuel system for an internal combustion engine having a ⁽⁹¹⁾ plurality of engine cylinders, the fuel system including:

5 a plurality of injectors (10), each of which is arranged to supply fuel to an associated one of the engine cylinders,

10 a rocker shaft (32) upon which a rocker member is pivotally mounted, wherein the rocker member is arranged to control one or more inlet and/or exhaust valves of an associated engine cylinder,

an accumulator fuel volume (12; 112) integrated within the rocker shaft (32) for supplying high pressure fuel to one or more of the plurality of injectors,

15 wherein the accumulator fuel volume (12; 112) is arranged to supply fuel at a first pressure level to one or more of the plurality of injectors (10) and wherein each injector includes a pumping element (20) for pressurising fuel to a second pressure level higher than the first pressure level.

20 2. The accumulator fuel system as claimed in claim 1, wherein the rocker shaft (32) is provided with a first axially extending passage (46) for receiving a lubricating fluid and a second axially extending passage (48) defining the accumulator fuel volume (12).

25 3. The accumulator fuel system as claimed in claim 1 or claim 2, including a first rocker member for controlling one or more engine cylinder inlet valves, a second rocker member for controlling one or more engine cylinder exhaust valves

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and a third rocker member (30) for transmitting drive to the pumping element (20) of an associated injector (10), wherein the first, second and third rocker members are pivotally mounted upon the rocker shaft (32).

5 4. The accumulator fuel system as claimed in any one of claims 1 to 3, wherein the rocker shaft (32) has a longitudinal axis which is arranged to extend substantially perpendicular to a longitudinal axis of the pumping element (20).

10 5. The accumulator fuel system as claimed in any one of claims 1 to 4, wherein the injectors are electronic unit injectors (10).

6. The accumulator fuel system as claimed in any one of claims 1 to 4, wherein each injector is associated with an electronic unit pump for increasing fuel pressure to the second pressure level.

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